EMC
TEST REPORT

Report No.: **EME-041156**

Model No.: **I-7005, I-7015, I-7019R, I-7045, I-7045D, I-7051, I-7051D, I-7055, I-7055D, I-7530, I-87017R, I-87018R, I-87040, I-87041, M-7017, M-7017-232, M-7017R, M-7018, M-7018R, M-7019R, FR-2053, FR-2057, SG-3016, I-2541**

Issued Date: **Dec. 13, 2004**

Applicant: **ICP DAS Co., Ltd.**
No. 111, Kuangfu N. Rd., Hukou Shiang, Hsinchu, Taiwan

Test By: **Intertek Testing Services Taiwan Ltd.**
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

Project Engineer

Brandon Huang

Brandon Huang

Reviewed By

Rico Deng

Rico Deng

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1. General Information

1.1 Identification of the EUT

Product:	ICPDAS CPU with Converter
Model No.:	I-7005
Applicant:	ICP DAS Co., Ltd.
Rated Power:	230Vac, 50Hz
Power Cord:	3C×18AWG ×1.5meter with 2 cores
Data Cable:	Fiber cable 10meter × 1
Sample receiving date:	Nov. 25, 2004
Testing date:	Nov. 26, 2004 ~ Dec.8, 2004

1.2 Additional information about the EUT

The EUT is an ICPDAS CPU with Converter, and was defined as information technology equipment.

According to the hardware aspect, we verified the models listed as below are series model to I-7005 (EUT), the difference please refer to the following table:

Model Number	Firmware
I-7005	8- channel Thermistor Input and 6-channel Alarm Output Module
I-7015	6-channel RTD Input Module
I-7019R	8-channel Universal Analog Input Module
I-7045	16-channel Isolated Digital Output Module
I-7045D	I-7045 with LED Display
I-7051	16-channel Isolated Digital Input Module
I-7051D	16-channel Isolated Digital Input Module
I-7055	8-channel Isolated Digital Input and 8-channel Isolated Digital Output Module
I-7055D	8-channel Isolated Digital Input and 8-channel Isolated Digital Output Module
I-7530	Intelligent RS-232 to CAN converter
I-87017R	8-channel Analog Input Module

Model Number	Firmware
I-87018R	8-channel Thermocouple Input Module
I-87040	32-channel Isolated Digital Input Module
I-87041	32-channel Isolated Digital Output Module
M-7017	8-channel Analog Input Module
M-7017-232	8-channel Analog Input Module
M-7017R	8-channel Analog Input Module with High Over Voltage Protection
M-7018	8-channel Thermocouple Input Module
M-7018R	8-channel Thermocouple Input Module with High Over Voltage Protection
M-7019R	8-channel Universal Input Module with High Over Voltage Protection
FR-2053	16-channel Isolated Digital Input Module
FR-2057	16-channel Isolated Digital Output Module
SG-3016	Isolated Strain Gauge Input Module
I-2541	RS-232/422/485 to Fiber Optic Converter

For more detail features, please refer to user's Manual.

1.3 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.
Notebook PC	Dell	PP01L	CN-03P83-48643-33O-3930
Fiber Optic Converter	ICP DAS	I-2541	N/A

2. Test Summary

Emission			
Standard	**Test Type**	**Result**	**Remarks**
EN 55022: 1998 +A1: 2000+A2: 2003 Class B	Conducted Test	PASS	Pass by –2.60 dB at 0.155 MHz Neutral Phase
	Radiated Test	PASS	Pass by –5.61 dB at 100.8 MHz With antenna polarization vertical
EN 61000-3-2: 2000 Class A	Harmonic current Emissions	PASS	Meet the requirements
EN 61000-3-3: 1995 +A1: 2001	Voltage fluctuation & Flicker	PASS	Meet the requirements

Immunity (EN 55024: 1998+A1: 2001+A2: 2003)				
Standard	**Test Type**	**Result**	**Performance Criteria**	**Test Judgment**
IEC 61000-4-2: 1995+A1: 1998+ A2: 2000	ESD test	PASS	Criterion B	Meets the requirements of Performance Criterion A
IEC 61000-4-3: 2002	RS test	PASS	Criterion A	Meets the requirements of Performance Criterion A
IEC 61000-4-4: 2004	EFT test	PASS	Criterion B	Meets the requirements of Performance Criterion A
IEC 61000-4-5: 2001	Surge test	PASS	Criterion B	Meets the requirements of Performance Criterion A
IEC 61000-4-6: 2003	CS test	PASS	Criterion A	Meets the requirements of Performance Criterion A
IEC 61000-4-11: 1994+A1: 2001	Dip test	PASS	1. >95% reduction-Performance Criterion B 2. 30% reduction-Performance Criterion C 3. >95% reduction-Performance Criterion C	Meets the requirements of Voltage Dips: 1. >95% reduction-Performance Criterion A 2. 30% reduction-Performance Criterion A 3. >95% reduction-Performance Criterion B

Remark:

The EUT has been tested/evaluated and pass the EN 55022 without modification.

3. Test Specifications

3.1 Standards

EN 55022: 1998+A1: 2000+A2: 2003 Electromagnetic compatibility - requirements for radio disturbance characteristics of information technology equipment.

EN 61000-3-2: 2000 Electromagnetic compatibility — Part 3. Limits
Section 2. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

EN 61000-3-3: 1995+A1: 2001 Electromagnetic compatibility — Part 3. Limits
Section 3. Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16 A

EN 55024: 1998+A1: 2001+A2: 2003 Information technology equipment —
Immunity characteristics Limits and methods of measurement.

3.2 Mode of operation during the test

The EUT was supplied with 230Vac, 50Hz
The EUT was tested in normal operating mode.

Magnetic field immunity test:
The equipment does not contain devices components susceptitable to magnetic fields, therefore, the test waived can be ignored.

3.3 Performance criteria

The performance criteria are based on the general criteria in the standard and specified by the manufacturer/derived from the product specification.

Criteria A:
The equipment shall continue to operate as intended. No performance or loss of function is allowed below performance level specified by manufacturer.

Criteria B:
Loss of function is allowed, provided the function self-recoverable or restored by the operation of the controls by the user in accordance with manufacturers instructions or after the test the equipment shall continue to operate as intended. Degradation of performance or loss of function is allowed after the application of the phenomena below a performance level specified by the manufacturer. During the test, degradation of performance is allowed. However, no change of actual operating state or stored data is allowed.

Criteria C:
Temporary degradation or loss of function or performance that requires operator Intervention or system reset.

3.4 Performance verification

The EUT has been monitored (or observed) based on manufacturer’s specification; the performance fulfilled the requirements of standard.

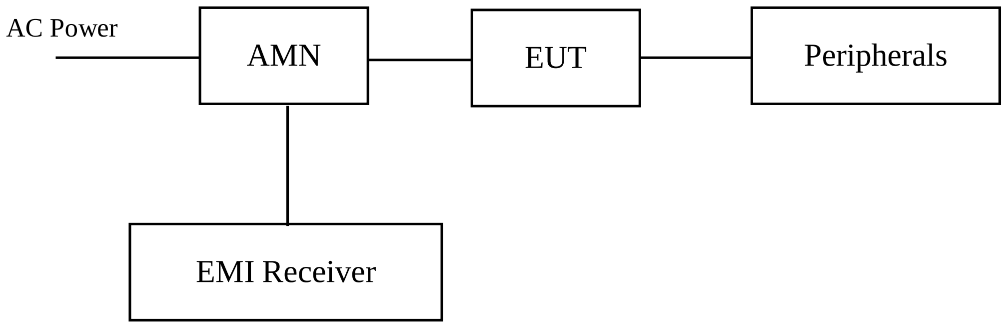
4. EN 55022 Conducted Emission Test

4.1 Mains Terminals Emission Test

4.1.1 Operating Environment

Temperature:	23 ℃ (10-40℃)	Atmospheric Pressure:	1023 hPa (860-1060hPa)
Relative Humidity:	55 % (10-90%)	Test Voltage:	230Vac, 50Hz

4.1.2 Test Procedure



The EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4meter space from a vertical reference plane. The EUT was connected to power mains through a Artificial Mains Network (AMN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.

The excess power cable between the EUT and the AMN was bundled. All connecting cables of EUT and peripherals were moved to find the maximum emission

4.1.3 Test Equipment

Equipment	Brand	Model No.	Intertek ID No.	Next Cal. Date
EMI Receiver	Rohde & Schwarz	ESCS 30	EC318	06/18/2005
AMN	Rohde & Schwarz	EHS3-Z5	EC320	01/08/2005
AMN	Rohde & Schwarz	ESH3-Z5	EC344	01/14/2005
Shield Room	N/A	N/A	N/A	N/A

Note: The above equipments are within the valid calibration period.

4.1.4 Conducted Emission Limit

Freq. (MHz)	Maximum RF Line Voltage			
	Class A (dB μ V)		Class B (dB μ V)	
	Q.P.	Avg.	Q.P.	Avg.
0.15~0.50	79	66	66~56	56~46
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

4.1.5 Uncertainty of Conducted Emission

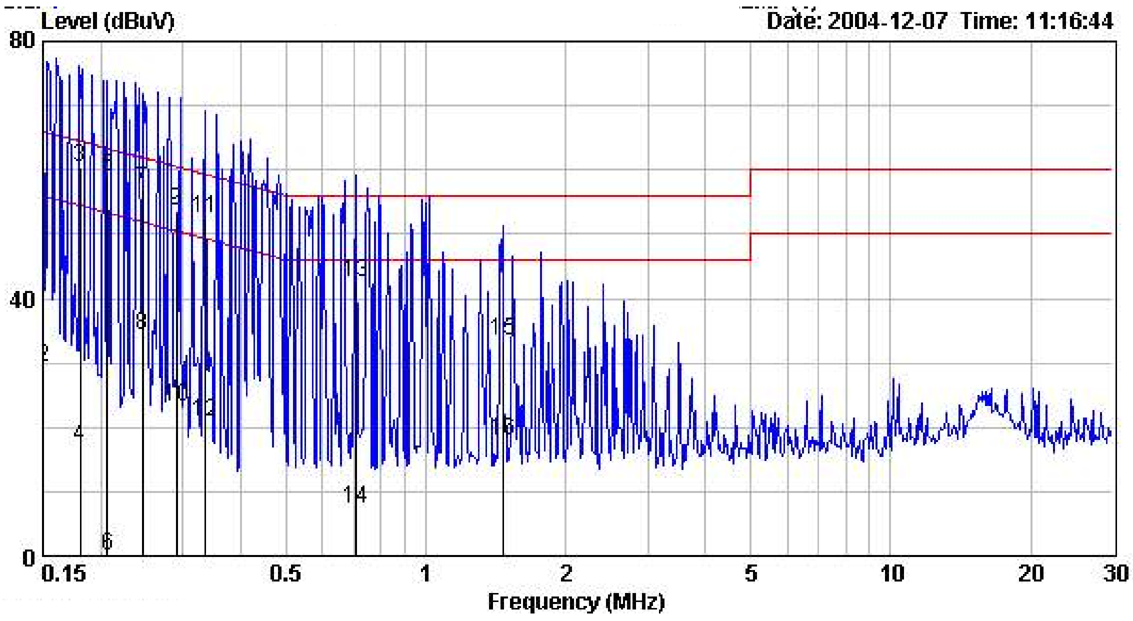
Expanded uncertainty (k=2) of conducted emission measurement is ±2.6 dB.

4.1.6 Mains Terminals Emission Data

Phase: Line
Model No.: I-7005
Test Condition: Normal operating mode

Phase	Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
LINE	0.150	0.10	62.87	66.00	29.24	56.00	-3.13	-26.76
LINE	0.180	0.10	60.49	64.48	16.93	54.48	-3.99	-37.55
LINE	0.206	0.10	58.82	63.35	0.10	53.35	-4.53	-53.25
LINE	0.246	0.10	56.71	61.90	34.33	51.90	-5.19	-17.57
LINE	0.291	0.10	53.70	60.50	23.18	50.50	-6.80	-27.32
LINE	0.335	0.10	52.54	59.32	20.76	49.32	-6.78	-28.56
LINE	0.709	0.10	42.51	56.00	7.35	46.00	-13.49	-38.65
LINE	1.465	0.11	33.32	56.00	17.88	46.00	-22.68	-28.12

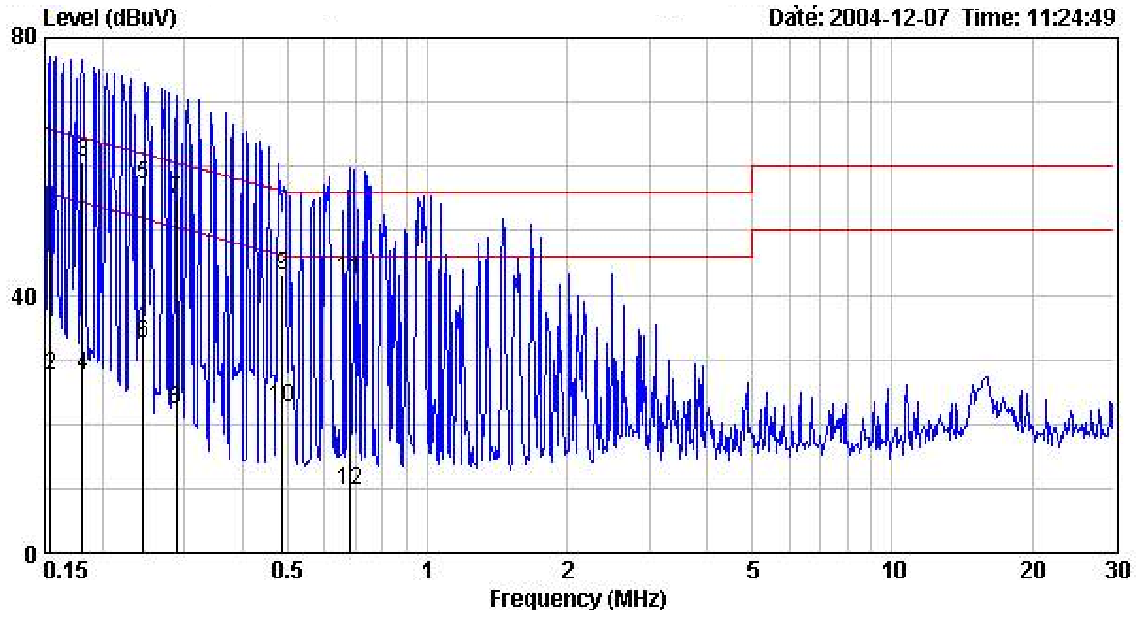
Remark:
1. Corr. Factor (dB)= AMN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: I-7005
Test Condition: Normal operating mode

Phase	Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
NEUTRAL	0.155	0.10	63.14	65.74	27.65	55.74	-2.60	-28.09
NEUTRAL	0.182	0.10	60.61	64.41	27.61	54.41	-3.80	-26.80
NEUTRAL	0.244	0.10	57.03	61.94	32.51	51.94	-4.91	-19.43
NEUTRAL	0.288	0.10	54.87	60.57	22.23	50.57	-5.70	-28.34
NEUTRAL	0.488	0.10	43.10	56.21	22.69	46.21	-13.11	-23.52
NEUTRAL	0.682	0.10	42.59	56.00	9.64	46.00	-13.41	-36.36

Remark:
1. Corr. Factor (dB)= AMN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

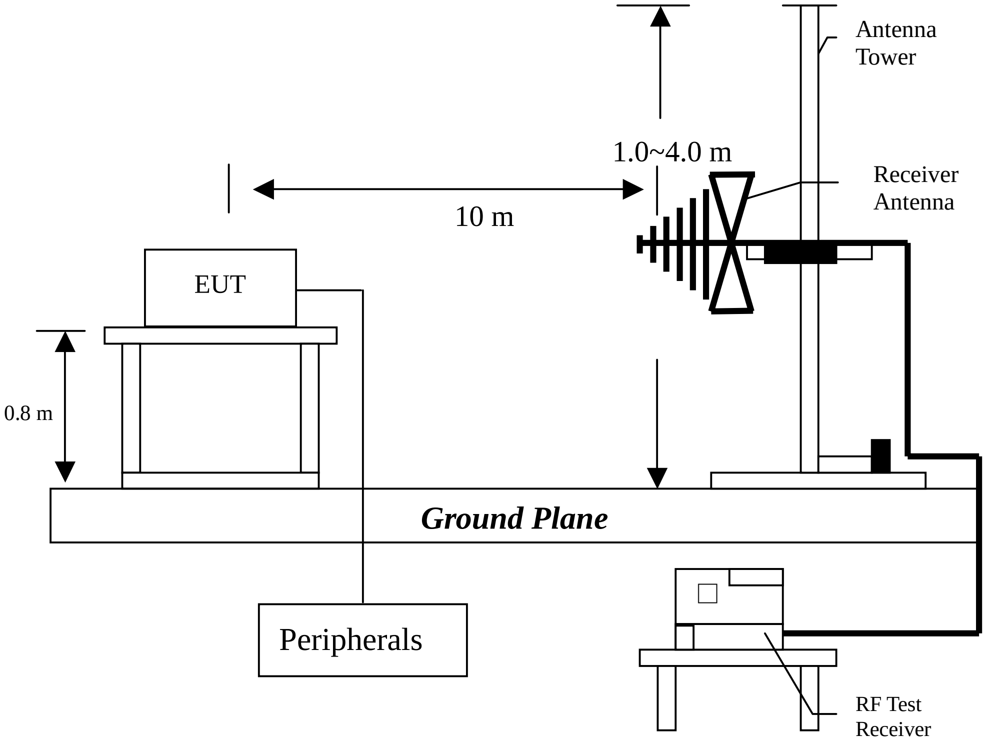


5. EN 55022 Radiated Emission Test

5.1 Operating Environment

Temperature:	28	℃	(10-40℃)	Atmospheric Pressure: 1023 hPa (860-1060hPa)
Relative Humidity:	40	%	(10-90%)	Test Voltage: 230Vac, 50Hz

5.2 Test Procedure



Radiated testing was performed at a 10 meters open area test site. The equipment under test were placed on a turntable top 0.8 m above ground. The table was 360 degrees to determine the position of the highest radiation. EUT is set 10 meters from the EMI receiving antenna, which is mounted on a variable height mast. The antenna height is varied between one meter and four meters above ground to find the maximum value of the field strength. Both horizontal polarization and vertical polarization of the antenna was set to conduct the measurement.

The bandwidth was set on the EMI meter 120 kHz.

The levels are quasi peak value readings. The frequency spectrum from 30 MHz to 1000 MHz was investigated.

5.3 Test Equipment

Equipment	Brand	Model No.	Intertek ID No.	Next Cat. Date
EMI Receiver	Rohde & Schwarz	ESCS 30	EC318	06/18/2005
EMI Spectrum	Rohde & Schwarz	ESMI	EC317	07/14/2005
Turn Table	Electro-Metrics	EM4710	EP306	06/06/2005
Bilog Antenna	Schaffner	CBL611213	EC367	02/06/2005
Antenna Tower	Electro-Metrics	EM-4720	EP307	06/06/2005
Ferrite Clamp	Rohde & Schwarz	EZ-24	N/A	N/A

Note: The above equipments are within the valid calibration period.

5.4 Radiated Emission Limit

Frequency (MHz)	Distance(m)	Class A(dB μ V/m)	Class B(dB μ V/m)
30~230	10	40	30
230~1000	10	47	37

Note:
1. The tighter limit shall apply at the edge between two frequency bands.
2. Distance refers to the distance in meters between the measuring instrument Antenna and the closest point of EUT .

5.5 Uncertainty of Radiated Emission

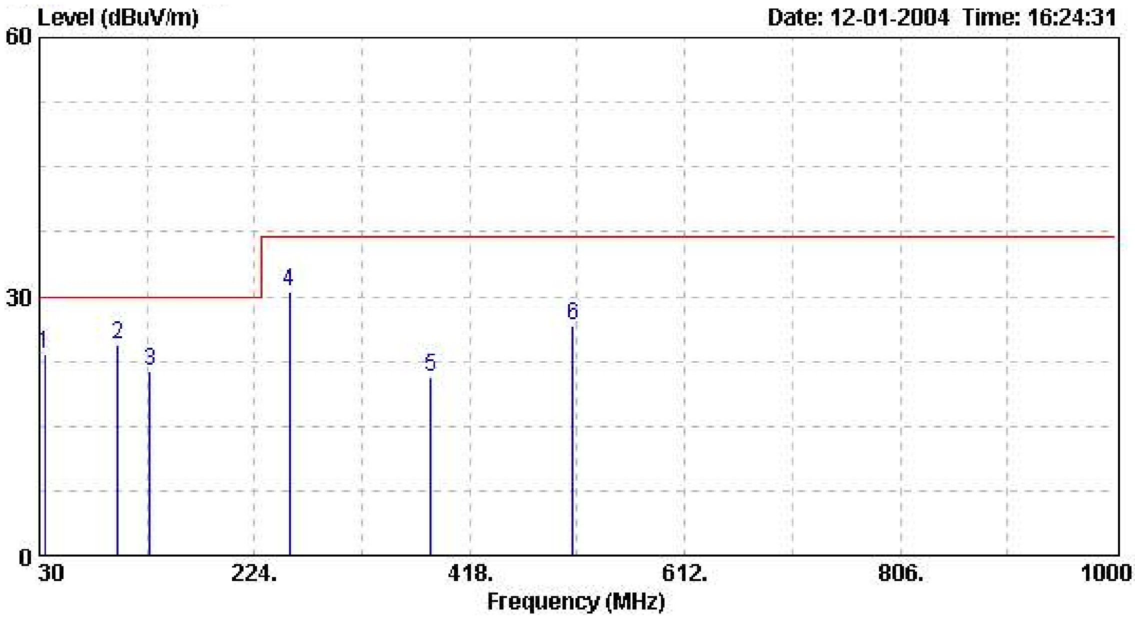
Expanded uncertainty (k=2) of radiated emission measurement is ±3.58 dB.

5.6 Radiated Emission Test Data

Polarity: Vertical
Model No.: I-7005
Test Condition: Normal operating mode

Freq	Pol/Phase	Factor	Read Level	Level	Limit Line	Over Limit	Ant Pos	Table Pos	Remark
MHz		dB	dBuV	dBuV/m	dBuV/m	dB	cm	deg	
34.9	VERTICAL	16.85	6.42	23.27	30.00	-6.73	100	286	QP
100.8	VERTICAL	13.18	11.21	24.39	30.00	-5.61	100	186	QP
129.9	VERTICAL	14.42	6.96	21.38	30.00	-8.62	100	273	QP
255.0	VERTICAL	15.98	14.47	30.45	37.00	-6.55	100	62	QP
383.1	VERTICAL	19.47	1.17	20.64	37.00	-16.36	100	92	QP
511.1	VERTICAL	22.04	4.54	26.58	37.00	-10.42	100	219	QP

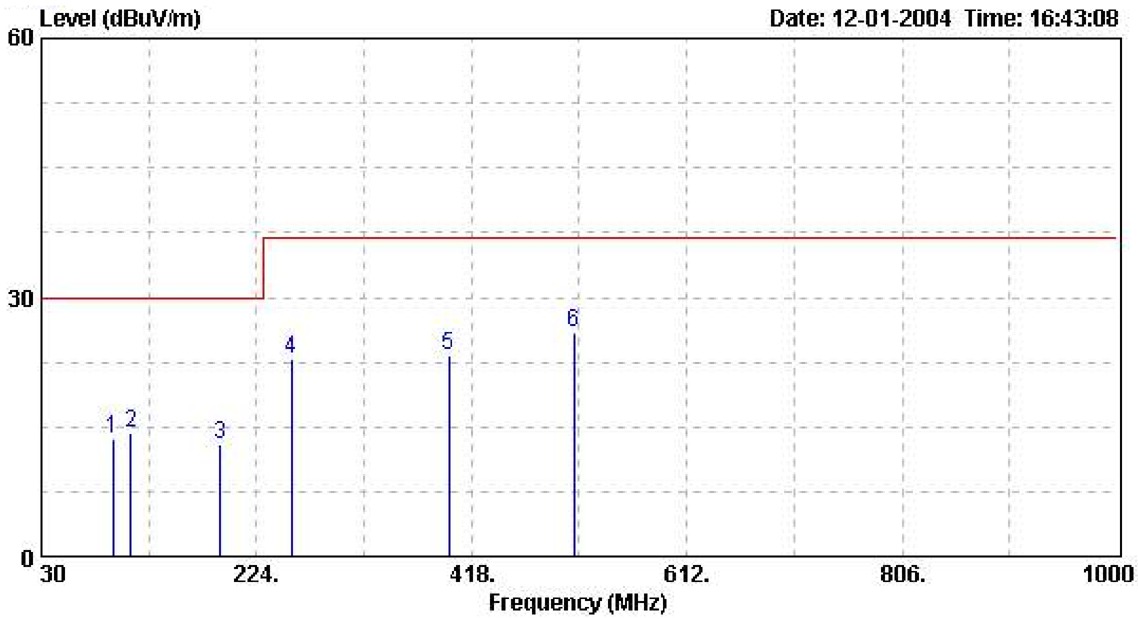
Remark:
1. Level (dB μ V/m)= Factor (dB/m)+ Read Level (dB μ V)
2. Factor = Antenna Factor (dB/m) + Cable Loss (dB)
3. Over Limit (Margin) (dB) = Level (dB μ V/m) – Limit Line(dB μ V/m)



Polarity: Horizontal
Model No.: I-7005
Test Condition: Normal operating mode

Freq	Pol/Phase	Factor	Read Level	Level	Limit Line	Over Limit	Ant Pos	Table Pos	Remark
MHz		dB	dBuV	dBuV/m	dBuV/m	dB	cm	deg	
95.0	HORIZONTAL	12.18	1.36	13.54	30.00	-16.47	385	127	QP
110.5	HORIZONTAL	14.08	0.23	14.31	30.00	-15.69	359	284	QP
191.0	HORIZONTAL	11.67	1.28	12.95	30.00	-17.05	342	182	QP
255.0	HORIZONTAL	15.98	6.82	22.80	37.00	-14.20	324	294	QP
397.6	HORIZONTAL	20.22	3.05	23.27	37.00	-13.73	338	328	QP
510.2	HORIZONTAL	22.02	3.91	25.93	37.00	-11.07	308	41	QP

Remark:
1. Level (dB μ V/m)= Factor (dB/m)+ Read Level (dB μ V)
2. Factor = Antenna Factor (dB/m) + Cable Loss (dB)
3. Over Limit (Margin) (dB) = Level (dB μ V/m) – Limit Line(dB μ V/m)



6. EN 61000-3-2 Harmonics

6.1 Operating Environment

Temperature:	25	℃	Atmospheric Pressure:	1023	hPa
Relative Humidity:	56	%	Test Voltage:	230Vac, 50Hz	

6.2 Test Procedure

Harmonics of the fundamental current were measured up to 2 kHz using a digital power analyzer. The test voltage was supplied from an AC source, which meets the requirements according to the standard.

The steady-state harmonic current measurements were carried out using averaging.

The transitory harmonics were measured during an observation period of 2.5 minutes. The disturbance duration time (limit 15 s) is defined as the total time under which the transitory harmonics exceeds the limit level for steady-state harmonics during an observation period of 2.5 minutes.

6.3 Test Equipment

Equipment	Brand	Model No.	Intertek ID No.	Next Cal. Date
EMC Emission Tester	EMC Partner	HARMONICS-1000	EC364	10/07/2005

Note: The above equipments are within the valid calibration period.

6.4 Test Result

EUT: I-7005

CLASSIFICATION: CLASS A
SUMMARY RESULT: PASS

Harmonic Current Results

Hn	AMPs	Current Limit	Result
1	0.130	NaN	Pass
2	0.008	1.080	Pass
3	0.023	2.300	Pass
4	0.003	0.430	Pass
5	0.015	1.140	Pass
6	0.003	0.300	Pass
7	0.004	0.770	Pass
8	0.002	0.230	Pass
9	0.002	0.400	Pass
10	0.0001	0.184	Pass
11	0.002	0.330	Pass
12	0.001	0.153	Pass
13	0.002	0.210	Pass
14	0.001	0.131	Pass
15	0.002	0.150	Pass
16	0.001	0.115	Pass
17	0.001	0.132	Pass
18	0.001	0.102	Pass
19	0.001	0.118	Pass
20	0.001	0.092	Pass

Hn	AMPs	Current Limit	Result
21	0.001	0.107	Pass
22	0.001	0.084	Pass
23	0.001	0.098	Pass
24	0.000	0.077	Pass
25	0.001	0.090	Pass
26	0.000	0.071	Pass
27	0.001	0.083	Pass
28	0.000	0.066	Pass
29	0.001	0.078	Pass
30	0.000	0.061	Pass
31	0.001	0.073	Pass
32	0.000	0.058	Pass
33	0.001	0.068	Pass
34	0.000	0.054	Pass
35	0.000	0.064	Pass
36	0.000	0.051	Pass
37	0.000	0.061	Pass
38	0.000	0.048	Pass
39	0.001	0.058	Pass
40	0.000	0.046	Pass

7. EN 61000-3-3 Voltage Fluctuations-Flicker

7.1 Operating Environment

Temperature:	25	℃	Atmospheric Pressure:	1023	hPa
Relative Humidity:	56	%	Test Voltage:	230Vac, 50Hz	

7.2 Test Procedure

The voltage changes at the supply terminals were measured using the voltage method.

The test voltage was supplied from an AC source which meets the requirements according to the standard. The voltage source has virtually zero internal impedance and is connected

(1 phase)
Z = 0.4 + j 0.25Ω (total impedance)

(3 phases)
Impedance in line conductor: Za = 0.25 + j 0.25 Ω
Impedance in neutral conductor: Zn = 0.15 +j 0.10 Ω

The short-term flicker P_{st} is measured during a time interval of 10 minutes.
The long-term flicker P_{lt} is evaluated from 12 subsequently measured short-term flicker values.

7.3 Test Equipment

Equipment	Brand	Model No.	Intertek ID No.	Next Cal. Date
EMC Emission Tester	EMC Partner	HARMONICS-1000	EC364	10/07/2005

Note: The above equipments are within the valid calibration period.

7.4 Test result

EUT: I-7005

SUMMARY RESULT: **PASS**

TEST CONDITIONS: STANDARD TEST CONDITIONS

	EUT DATA	LIMIT	RESULT	TEST ENABLED
Pst max	**0.010**	**1.00**	**PASS**	☐
Plt max	**0.010**	**0.65**	**PASS**	☐
d_c %	**0.15**	**3.30**	**PASS**	☐
d_{max} %	**0.30**	**4.00**	**PASS**	☒
$d_{(t)}$ Sec.	**0.00**	**0.50**	**PASS**	☐

8. IEC 61000-4-2 Electrostatic Discharge Immunity Test

8.1 Operating Environment

Temperature:	20 ℃	(15-35℃)	Atmospheric Pressure:	1023 hPa
Relative Humidity:	48 %	(30-60%)	Test Voltage:	230Vac, 50Hz

8.2 Purpose

The object of the test is to evaluate the ESD immunity performance of EUT.

8.3 Test Set-Up

A horizontal coupling plane (HCP) was placed on a non-metallic table 0.8 m above a reference ground plane (RGP) and connected to it with a cable with two 470 kΩ resistors. The EUT was placed on an insulation sheet on the HCP and was operated according to the specified operating mode.

A vertical coupling plane (VCP) was connected to the RGP with a cable with two 470 kΩ resistors.

8.4 Test Conditions

Test level:	Air discharge	-------	+/- 8kV
	Contact discharge	-------	+/- 4kV

Single discharge at 1 second interval positive discharge and negative discharge
The selected test points are listed in this table, the numbers refer to the figures attached.

8.5 Test Equipment

Equipment	Manufacturer	Model No.	Intertek ID No.	Next Cal. Date
Electrostatic Discharge System	NoiseKen	ESS-2002	EC362	06/17/2005

Note: The above equipments are within the valid calibration period.

8.6 Test Result

Point of Discharge	Applied Voltage (kV)	Total No. of Discharge (Each Point)	Result	Criteria Level	Remark
(Contact) Point 6-14 Refer to figure attached 1	±2	25	P	A	-
	±4	25	P	A	-
(Air) Point 1-5 Refer to figure attached 1	±2	20	P	A	-
	±4	20	P	A	-
	±8	20	P	A	-
HCP (4 sides)	±2	25	P	A	-
	±4	25	P	A	-
VCP (4 sides)	±2	25	P	A	-
	±4	25	P	A	-

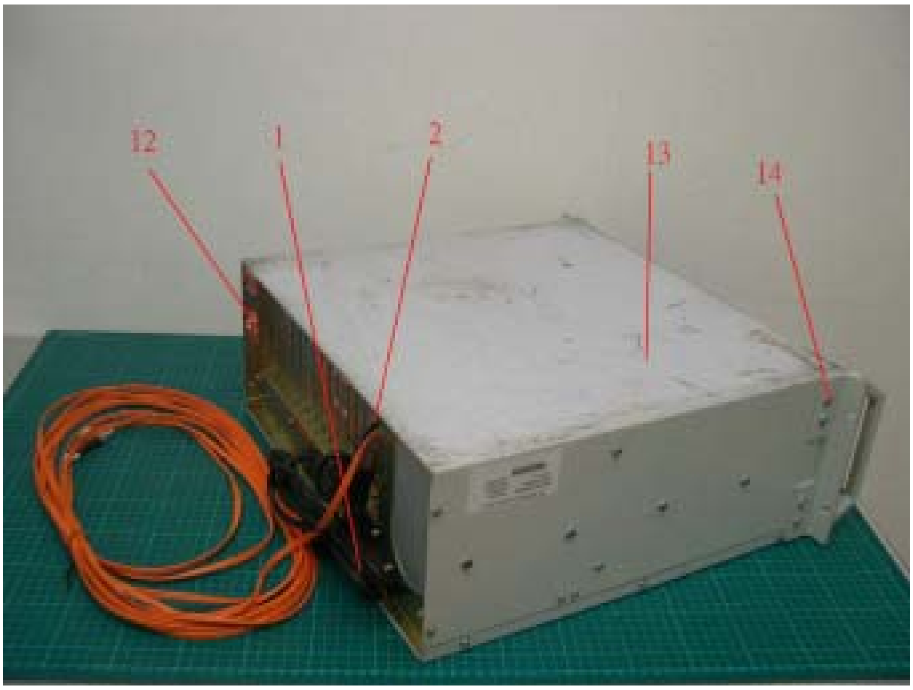
Note: 1. “P” means the EUT pass the test.
Note: 2. “-“ means not applicable

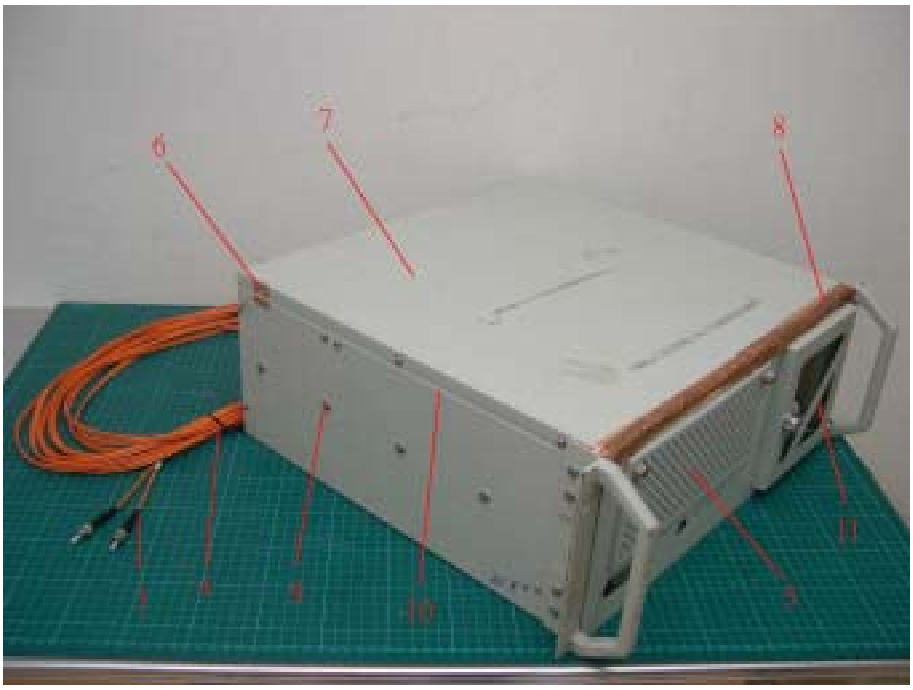
☒ Meet criterion A – operated as intended during and after the test

☐ Meet criterion B – operated as intended after the test

☐ Meet criterion C – loss/ error of function

Figure 1: ESD Discharge Points





9. IEC 61000-4-3 Radiated, Radio-Frequency, Electromagnetic Field Immunity Test

9.1 Operating Environment

Temperature:	20	℃	Atmospheric Pressure:	1023	hPa
Relative Humidity:	48	%	Test Voltage:	230Vac, 50Hz	

9.2 Purpose

This test method subjects the EUT to a power source of disturbance comprising electric and magnetic field, simulating those coming from intentional RF transmitters.

9.3 Test Set-Up

The EUT was placed on a non-metallic table 0.8 m above the reference ground plane (RGP) and was operated according to its specified operating mode.

Ferrite tiles/absorbers were placed on the RGP between the EUT and the antenna to reduce the reflections from the RGP. The EUT and its cables were exposed for the electromagnetic field for 1.5m vertically and 1.5m horizontally.

The distance between antenna and EUT is 3 meter.

9.4 Test Conditions

Test level	Test field strength V/m	Modulation
1	1	1 kHz 80% AM
2	3	1 kHz 80% AM
3	10	1 kHz 80% AM
X	Special	1 kHz 80% AM

The frequency steps : 1％, Log sweep
Dwell time : 3 sec
Frequency range : 80MHz~1GHz
Test ports : Enclosure port
Test field strength : 3V/m

9.5 Test Equipment

Equipment	Manufacture	Model No.	Intertek ID No.	Next Cal. Date
An-echoic chamber 7m×3m×3m	Comtest Instrumentation	9708093	EC328	06/17/2005
RF signal Generator	Marconi	2024	EC301	07/11/2005
Dual Band RF Power Amplifier	Kalmus	757LCB	EP314	N/A
High Power Microwave Amplifier Series	MILMEGA	AS0102-30	EP318	N/A
Bi-log Antenna	EMCO	3141	EC304	12/17/2005
RF Power Meter	Boonton	4230	EC302	07/14/2005
Field Probe	Holaday	HI-4422	EC307	07/08/2005

Note: The above equipments are within the valid calibration period.

9.6 Generation Of The Electromagnetic Field

The electromagnetic field is generated from a computer controlled signal generator. The output power is amplified and then radiated from broadband log periodic antennas. For each sweep a pre-recorded empty chamber calibration file is used to establish the required field strength. When using these files the field strength inside an area of 1.5/1.0 m x 1.5m is in accordance with the standard.

9.7 Test Results

Exposed Side: ☒ Front ☒ Left ☒ Rear ☒ Right

H: Horizontal V: Vertical

Frequency (MHz)	Horizontal/ Vertical	Result	Criteria Level	Remark
80MHz to 1GHz	H	P	A	-
80MHz to 1GHz	V	P	A	-

Note: 1. “P” means the EUT pass the test.
Note: 2. “-“ means not applicable

☒ Meet criterion A – operated as intended during and after the test

☐ Meet criterion B – operated as intended after the test

☐ Meet criterion C – loss/error of function

10. IEC 61000-4-4 Electrical Fast Transient/Burst Immunity Test

10.1 Operating Environment

Temperature:	20 ℃ (15-35℃)	Atmospheric Pressure:	1023 hPa
Relative Humidity:	50 % (25-75%)	Test Voltage:	230Vac, 50Hz

10.2 Purpose

The purpose of this test is to evaluate the EUT performance during the repetitive transient bursts applied to power port and ports for I/O ports.

For power port testing, the EUT was placed on a non-metallic table 0.8 m above a reference ground plane (RGP) and was put into operation according to the specified operating mode.

10.3 Test Set-Up

For I/O ports testing, the EUT was placed on a non-metallic support 0.1 m above a reference ground plane (RGP) and operated in the operating mode specified.

10.4 Test Condition

Open-circuit output test voltage (±10%) and repetition rate of the impulses (±20%)				
Level	On power supply port, PE		On I/O (Input/Output) signal, Data and control ports	
	Voltage peak KV	Repetition rate kHz	Voltage peak KV	Repetition rate kHz
1	0.5	5 or 100	0.25	5 or 100
2	1	5 or 100	0.5	5 or 100
3	2	5 or 100	1	5 or 100
4	4	5 or 100	2	5 or 100
X(1)	Special	Special	Special	Special
NOTE 1 Use of 5 kHz repetition rates is traditional; however, 100 kHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types. NOTE 2 With some products, there may be no clear distinction between power ports and I/O ports, in which case it is up to product committees to make this determination for test purposes.				
(1) "x" is an open level. The level has to be specified in the dedicated equipment specification				

10.5 Test Equipment

Equipment	Manufacture	Model No.	Intertek ID No.	Next Cal. Date
EFT/Burst Tester	Keytek	CE40	EC312	07/25/2005

Note: The above equipments are within the valid calibration period.

10.6 Test Results

Level	Polarity	Power supply line and Protective earth terminal	Signal Line & Control Line	Criteria Level
0.25kV	+	-	-	-
0.25kV	-	-	-	-
0.5kV	+	-	P	A
0.5kV	-	-	P	A
1kV	+	P	-	A
1kV	-	P	-	A
2kV	+	-	-	-
2kV	-	-	-	-
4kV	+	-	-	-
4kV	-	-	-	-

Note: 1. “P” means the EUT pass the test.
Note: 2. “-“ means not applicable

☒ Meet criterion A - operated as intended during and after the test

☐ Meet criterion B - operated as intended after the test

☐ Meet criterion C - loss/error of function

11. IEC 61000-4-5 Surge Immunity Test

11.1 Operating Environment

Temperature:	20 ℃ (15-35℃)	Atmospheric Pressure:	1023 hPa
Relative Humidity:	50 % (10-75%)	Test Voltage:	230Vac, 50Hz

11.2 Purpose

The object of this test is to establish a common reference to evaluate the performance of EUT when subjected to high-energy disturbances on the power and interconnection lines.

11.3 Test Set-Up

The EUT was placed on a non-metallic support 0.8 m above a reference ground plane and was put into operation according to the specified operating mode.

11.4 Test Conditions

For power supply line

Level	Open circuit test voltage kV +/- 10%	Remark
1	0.5	L1 to L2
2	1.0	L1 to L2
3	2.0	L1 to Gnd L2 to Gnd
4	4.0	-
X	Special	-
Note: “X” is an open class. This level can be specified in the product specification		

Surge wave form: 1.2 x 50 μs, Repetition rate: 1 /min (max)

11.5 Test Equipment.

Equipment	Manufacture	Model No.	Intertek ID No.	Next Cal. Date
Surge Tester	Key Tek	EMC Pro	EC313	09/24/2005

Note: The above equipments are within the valid calibration period.

11.6 Test Results

Test 5 times for each voltage

Phase			0	45	90	135	180	215	270	315	Criteria level
Volt	Mode	Polarity									
0.5kV	L N	+	P	-	P	-	P	-	P	-	A
		-	P	-	P	-	P	-	P	-	A
1kV	L N	+	P	-	P	-	P	-	P	-	A
		-	P	-	P	-	P	-	P	-	A
1kV/2kV	L G	+	P	-	P	-	P	-	P	-	A
		-	P	-	P	-	P	-	P	-	A
	N G	+	P	-	P	-	P	-	P	-	A
		-	P	-	P	-	P	-	P	-	A

Note: 1. “P” means the EUT pass the test.
Note: 2. “-“ means not applicable

☒ Meet criterion A - operated as intended during and after the test

☐ Meet criterion B - operated as intended after the test

☐ Meet criterion C - loss/error of function

12. IEC 61000-4-6 Immunity To Conducted Disturbances, Inducted By Radio-Frequency Fields

12.1 Operating Environment

Temperature:	20	°C	Atmospheric Pressure:	1023	hPa
Relative Humidity:	50	%	Test Voltage:	230Vac, 50Hz	

12.2 Purpose

The test method subjects the EUT to a power source of disturbance comprising electric and magnetic field, simulating those coming from intentional RF transmitters.
The measurement is for evaluating the performance of EUT when subjected to RF conducted disturbance.

12.3 Test Set-Up

The EUT was placed on a non-metallic support 0.1 m above a reference ground plane (RGP) with the coupling/decoupling network (CDN) placed 0.3 m from the EUT on the RGP. The injection clamp was placed 0.3 m from the EUT on the RGP.

12.4 Test Conditions

Test level	Voltage (Vrms)	Modulation
1	1	1 kHz 80% AM
2	3	1 kHz 80% AM
3	10	1 kHz 80% AM
X	Special	1 kHz 80% AM

The frequency steps	: 1％, Log sweep
Dwell time	: 3 sec
Frequency range	: 150kHz to 80MHz
Test ports	: AC port, Signal port
Test voltage	: 3Vrms

12.5 Test Equipment

Equipment	Manufacture	Model No.	Intertek ID No.	Next Cal. Date
RF signal Generator	Marconi	2024	EC301	07/11/2005
Dual Band RF Power Amplifier	Kalmus	757LCB	EP314	N/A
Coupling network	Comtest instrument	4412-016	EC305	01/05/2005
Coupling network	Comtest instrument	4413-016	EC306	01/05/2005
RF Power Meter	Boonton	4230	EC302	07/14/2005
RF Injection Clamp	Luthi	EM101	EC308	01/05/2005
Coupling And Decoupling Network	Schaffner	CDN T400	EC385	04/01/2005

Note: The above equipments are within the valid calibration period.

12.6 Generation And Calibration Of The Disturbance Signal

The disturbance signal is generated from a computer controlled signal generator.
The output signal is amplified and injected to the CDN/injection clamp. The disturbance signal level was calibrated as specified in the standard. A power meter was connected to the EUT side of the CDN through a 150 -50Ω adapter. The auxiliary equipment (AE) side of the network was terminated with 150Ω to ground during the calibration. The generator settings obtained during the calibration procedure were later repeated in the tests.

12.7 Test Results

Frequency (MHz)	Test Port/Line	Result	Criteria Level	Remark
0.15MHz to 80MHz	Power Line	P	A	-
0.15MHz to 80MHz	Signal Line	P	A	-

Note: 1. “P” means the EUT pass the test.
Note: 2. “-“ means not applicable

☒ Meet criterion A – operated as intended during and after the test

☐ Meet criterion B – operated as intended after the test

☐ Meet criterion C – loss／error of function

13. IEC 61000-4-11 Voltage Dips, Short Interruptions And Voltage Variations Immunity Test

13.1 Operating Environment

Temperature: 20 ℃ (15-35℃) Atmospheric Pressure: 1023 hPa
Relative Humidity: 50 % (25-75%) Test Voltage: 230Vac, 50Hz

13.2 Purpose

The object of this standard is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to voltage dips, short interruptions, and voltage variations.

13.3 Test Set-Up

The EUT was placed on a non-metallic support 0.8 m above a reference ground plane and was put into operation according to the specified operating mode.

13.4 Test Condition

Reduction '% of rated	Test Level % U_T	Duration (Period)	Tests	Recovery Time
>95% Dip	0% Short Circuit	0.5	3	10 Sec.
>95% Dip	0% Open Circuit	0.5	3	10 Sec.
30% Dip	70%	25	3	10 Sec.

Test Level % U_T	Duration (Period)	Tests	Recovery Time
0% Short Circuit	250	3	10 Sec.
0% Open Circuit	250	3	10 Sec.

13.5 Test Equipment

Equipment	Manufacturer	Model No.	Intertek ID No.	Next Cal. Date
Dip Tester	Keytek	EMC Pro	EC313	09/24/2005

Note: The above equipments are within the valid calibration period.

13.6 Generation Of The Disturbance Signal

The disturbance signal is generated using a programmable AC power source with pre-programmed test sequences for each test.

13.7 Test Result

I. Dip of mains voltage

Test Level	Reduction '% of rated	Test Level % U_T	Duration (Period)	Tests	Recovery Time	Criteria Level
1	>95% Dip	0% Short Circuit	0.5	3	10 Sec.	A
	>95% Dip	0% Open Circuit	0.5	3	10 Sec.	A
2	30% Dip	70%	25	3	10 Sec.	A

II. 0％of mains voltage

Test Item	Test Level % U_T	Duration (Period)	Tests	Recovery Time	Criteria Level
1	0% Short Circuit	250	3	10 Sec.	B
2	0% Open Circuit	250	3	10 Sec.	B

☐ Meet criterion A – operated as intended during and after the test

☒ Meet criterion B – operated as intended after the test

☐ Meet criterion C – loss／error of function

Appendix A1: External photo of EUT





Appendix B1: Conducted Emission Test Set-up





Appendix B2: Radiated Emission Test Set-up



